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# INVITED SPEAKER: Why and how to calculate momentum dependent self-energy for strongly correlated materials

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## Abstract content <br>   (Max 300 words)<br><a href="http://events.saip.org.za/getFile.py/a target="_blank">Formatting &<br>Special chars</a>

Dual nature of electronic spectrum is observed in many correlated electron systems in which 'wave'-like (itinerant) and 'particle'-like (localized) electronic states coexist. This universal behavior is observed in a large class of correlated materials including copper-oxide superconductors, actinides, iron-pnictides, iron-chalcogenides, various complex-oxides, and transition metal di-chalcogenides. Modeling such correlated systems was challenging since both Fermi liquid theory and dynamical mean-field theory become inadequate here. One needs to go beyond and include the full momentum dependence of the self-energy due to non-local density-density correlations. We introduce a momentum-resolved density-fluctuation (MRDF) theory appropriate for this problem.[1-3] Our MRDF model allows us to calculate momentum-dependent self-energy due to various density-density fluctuations. Here, I will present results for several representative correlated materials including cuprate superconductors, actinide compounds, and various complex oxides. The momentum-dependence of self-energy turns out to be crucial to these materials reproducing 'Fermi-arc' feature; universal 'waterfall'-like dispersion as seen in many materials; unique (experimental and theoretical) identification of Mott-gap and antiferromagnetic gap being separated at different energy scale (this is unexpected from the typical Mott physics). We find a generic trend in the dispersion and spectral weight anomaly across all these materials, despite their low-energy properties being very different.
[1] T. Das, J.-X. Zhu, M. Graf, Phys. Rev. Lett. 108, 017001 (2012).
[2] T. Das, R. S. Markiewicz, A. Bansil, Adv. Phys 63, 151 (2013).
[3] R. S. Dhaka, et al., Phys. Rev. B 92, 035127 (2015).
[4] X. Yin, et al. Phys. Rev. Lett. (in production 2016).

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